Overview of Montana's Draft Numeric Nutrient Criteria and their Implementation

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Presentation Outline

- Numeric Nutrient Criteria
  - Nutrient criteria development in Montana, Nation
  - Status of the Clark Fork River
  - How nutrients affect beneficial uses in streams, large rivers, lakes
  - Criteria derivation for above waterbodies

- Permitting Numeric Nutrient Criteria
  - Proposed critical low flow
  - Use of the 1991 EPA *Technical Support Document*

- Variances from Numeric Nutrient Criteria
  - Why, legislative history
  - Types

- Ongoing Work with the Nutrient Work Group
  - Nondegradation
  - Defined stepped reductions in nutrients from WWTPs
  - Other

What are "Nutrients"?

- In a water quality context, refers to concentrations of nitrogen and phosphorus
  - Total N, total P
  - Soluble nutrients (nitrate, nitrite, ammonium, soluble phosphate)
- Nutrient concentrations presented here are to prevent surface water over-enrichment, and are at much lower levels than those that protect human health

Why Numeric Nutrient Criteria?

- Existing standards are narrative

  "waters must be free from substances….which produce undesirable aquatic life."

- Nitrogen and phosphorus over-enrichment impacts other, adopted narrative & numeric WQ standards:
  - Dissolved oxygen, pH, nuisance algal growth

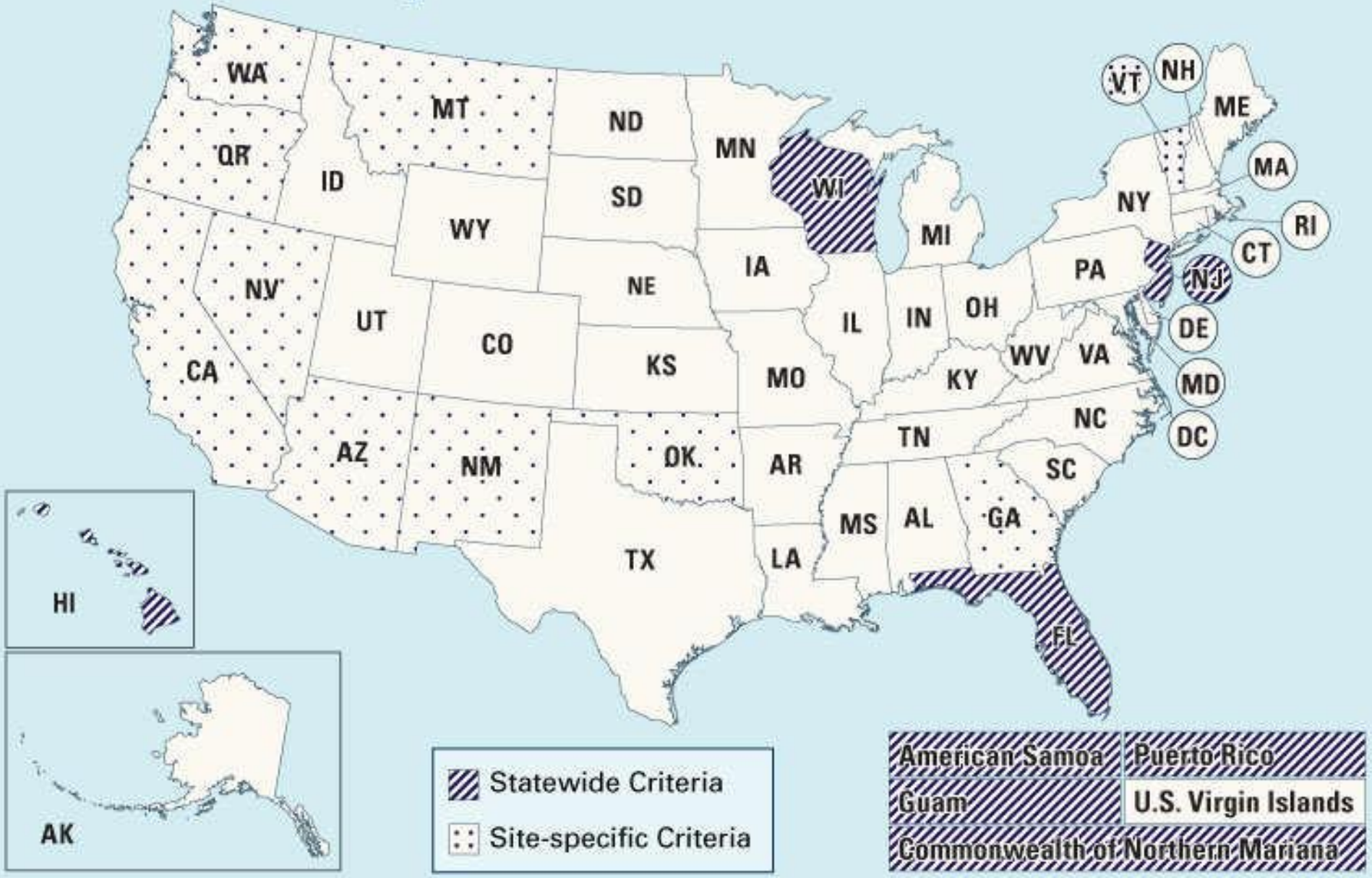
- Numeric criteria provide more consistent permitting and TMDL application

Overview of Nutrient Criteria Development in MT

- 1990s: Clark Fork River criteria derived; VNRP
- 2001: DEQ begins criteria development for all surface waters
- 2002: Clark Fork River criteria adopted as standards by BER
- 2003-2008: Statewide criteria for wadeable streams generally identified. DEQ develops a system for establishing zones for different criteria. Large river criteria development started.
- 2009: SB 95 adopted, allows variances from nutrient standards on a case-by-case; NWG created
- 2011: SB 367 adopted, allows for general variances
- 2011-present: Implementation refinement, with NWG

January 2013

Numeric Phosphorus Criteria for Rivers and Streams



January 2013

Numeric Nitrogen Criteria for Rivers and Streams

How Goes the Clark Fork River?

1989: Basin-wide phosphate laundry soap ban
1998: Voluntary Nutrient Reduction Program (VNRP) signed
2002: BER adopts nutrient & algae standards
- 20-39 µg TP/L, 300 µg TN/L (summer)
- 150 mg Chl*a*/m^2 (summer max)

2004: WWTP upgrade in Missoula (Butte: major upgrade in 2015)
- Other improvements in place by this time

1998 to 2009:

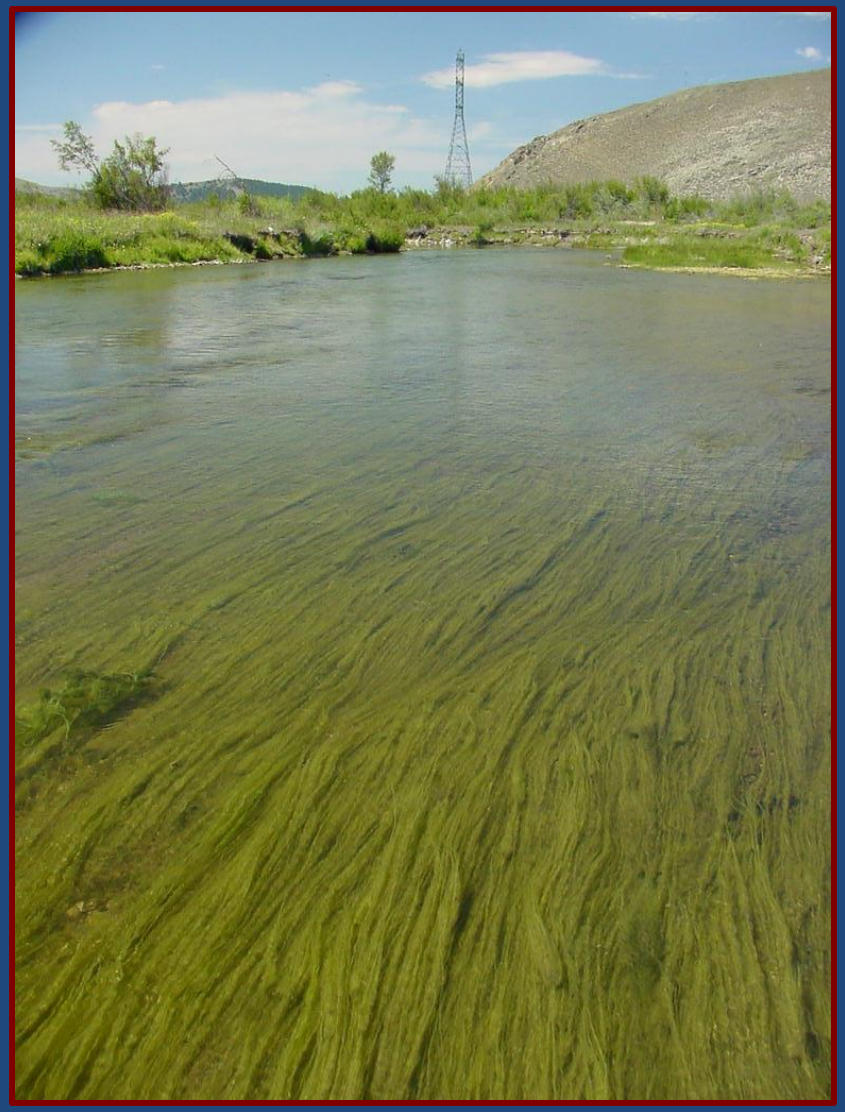
✓ TP significantly declined basin-wide

✓ TN did not significantly decline basin-wide (trending down d/s of Missoula)

✓ Benthic algal biomass significantly declining at all sites downstream of Missoula

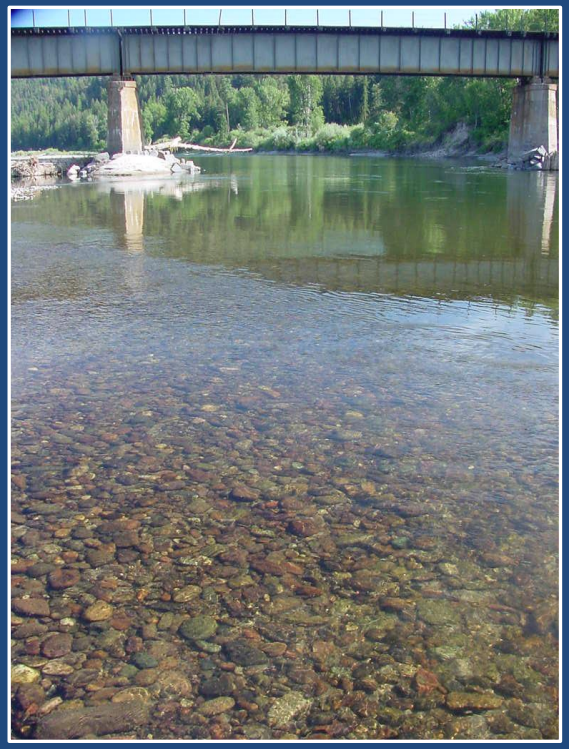
✓ Algal biomass standards now being met consistently d/s of Missoula

✓ Benthic algae biomass not significantly declining upstream of Missoula

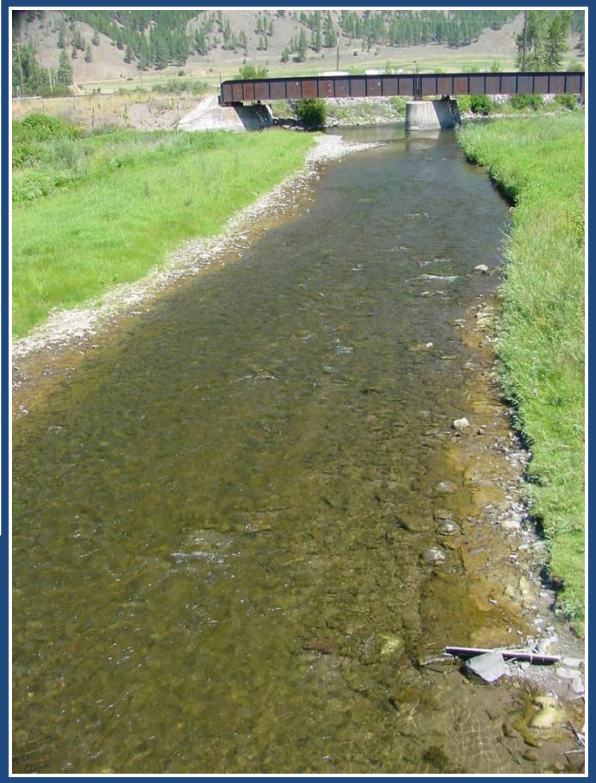


Nuisance algal growth, rivers & streams

Attached algae growth commonly quantified as chlorophyll *a* per square meter of stream bottom



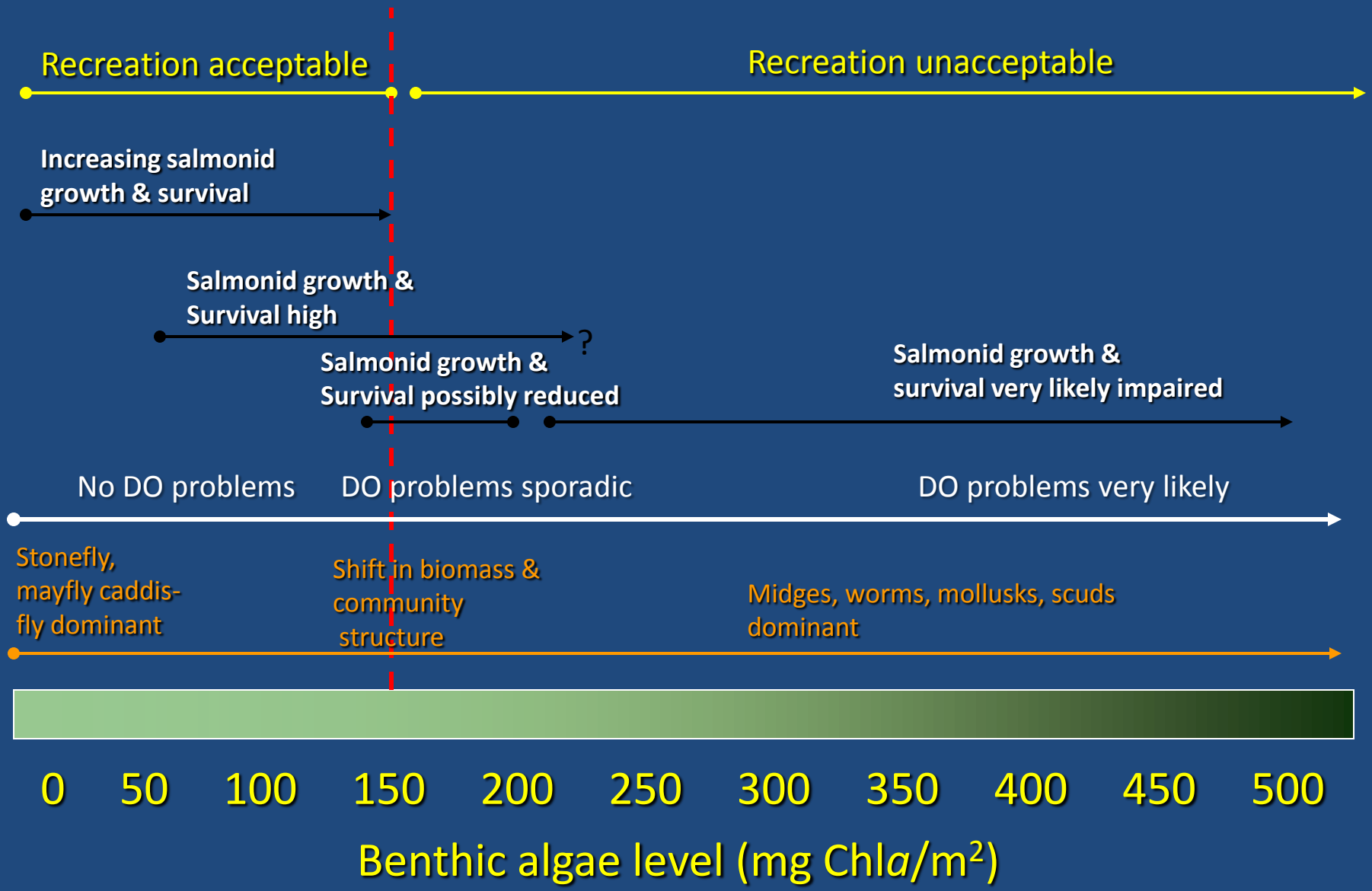
40 mg Chl*a*/m^2



120 mg Chl*a*/m^2

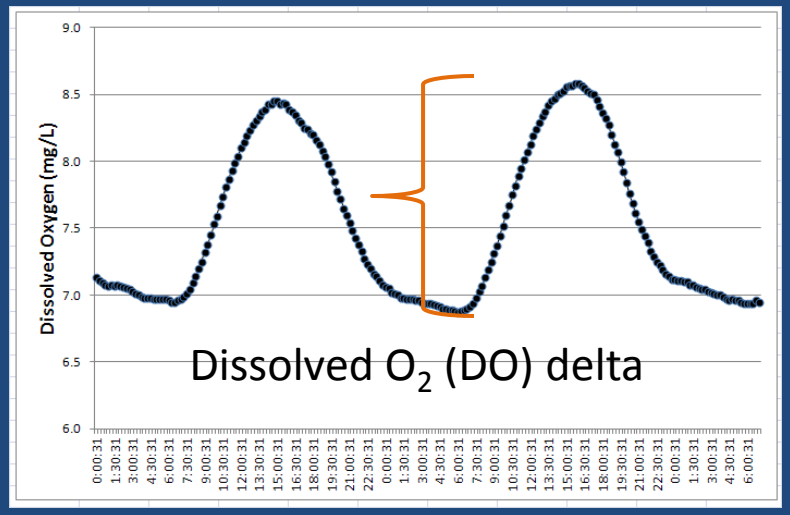
300 mg Chl*a*/m^2

Known/likely effects on wadeable-streams at different algae levels (western MT)



For eastern Montana wadeable streams, different assessment tools that link to excess nutrients are being used

Known/likely effects on wadeable prairie streams at different DO deltas (Eastern MT)



Diverse fishery including sensitive species (e.g., smallmouth bass, silvery minnow)

Loss of sensitive species, dominance by tolerant ones (e.g., carp)

No known DO problems

DO below minimum state standards seasonally

0 2.5 5.0 7.5 10

Dissolved Oxygen Delta (daily MAX – daily MIN)

Deriving Numeric Nutrient Criteria: Wadeable Streams

3 major pieces:

1) Identify geographic zones for specific criteria

2) Understand cause-effect relationships between nutrients and beneficial uses
   - Requires determining "harm to use"
   - Different expectations for different regions of the state

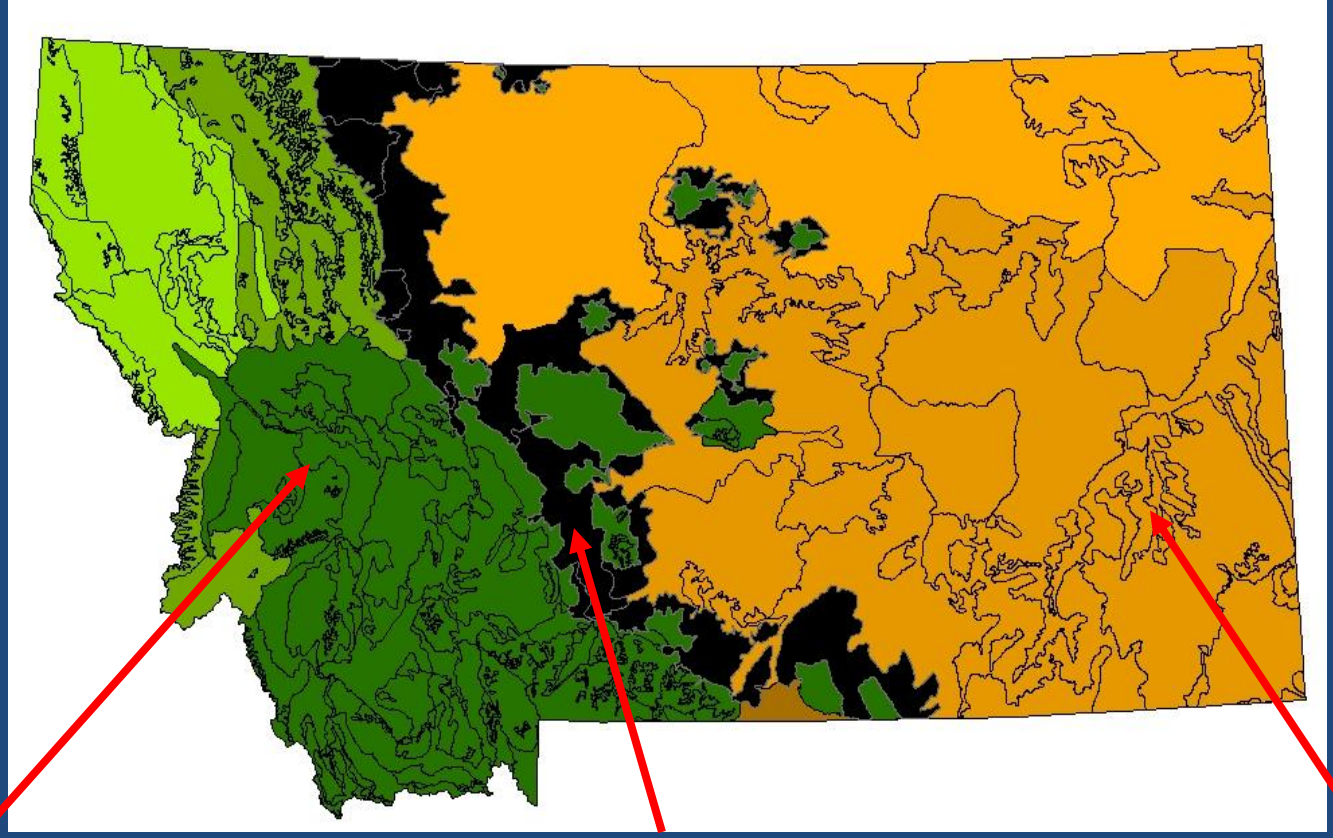
3) Characterize water quality of reference sites
   - Data from 2 and 3 considered together

Deriving Numeric Nutrient Criteria for Wadeable Streams: the Geospatial Frame

- Nutrient concentrations vary naturally — geology, soils, climate, vegetation
- DEQ tested these frames:
  - Ecoregions
  - Lithology (surface geology)
  - Strahler Stream Order
- Best frame maximizes variance between zones, minimizes variance within zones
- Focused on reference stream data from the zones

Deriving Numeric Nutrient Criteria for Wadeable Streams: the Geospatial Frame

- Level III & IV ecoregions worked better than surface geology and stream order
  - Significantly explained nutrient concentration variation (typically 60-78% of variation in reference data)
  - Practical to apply

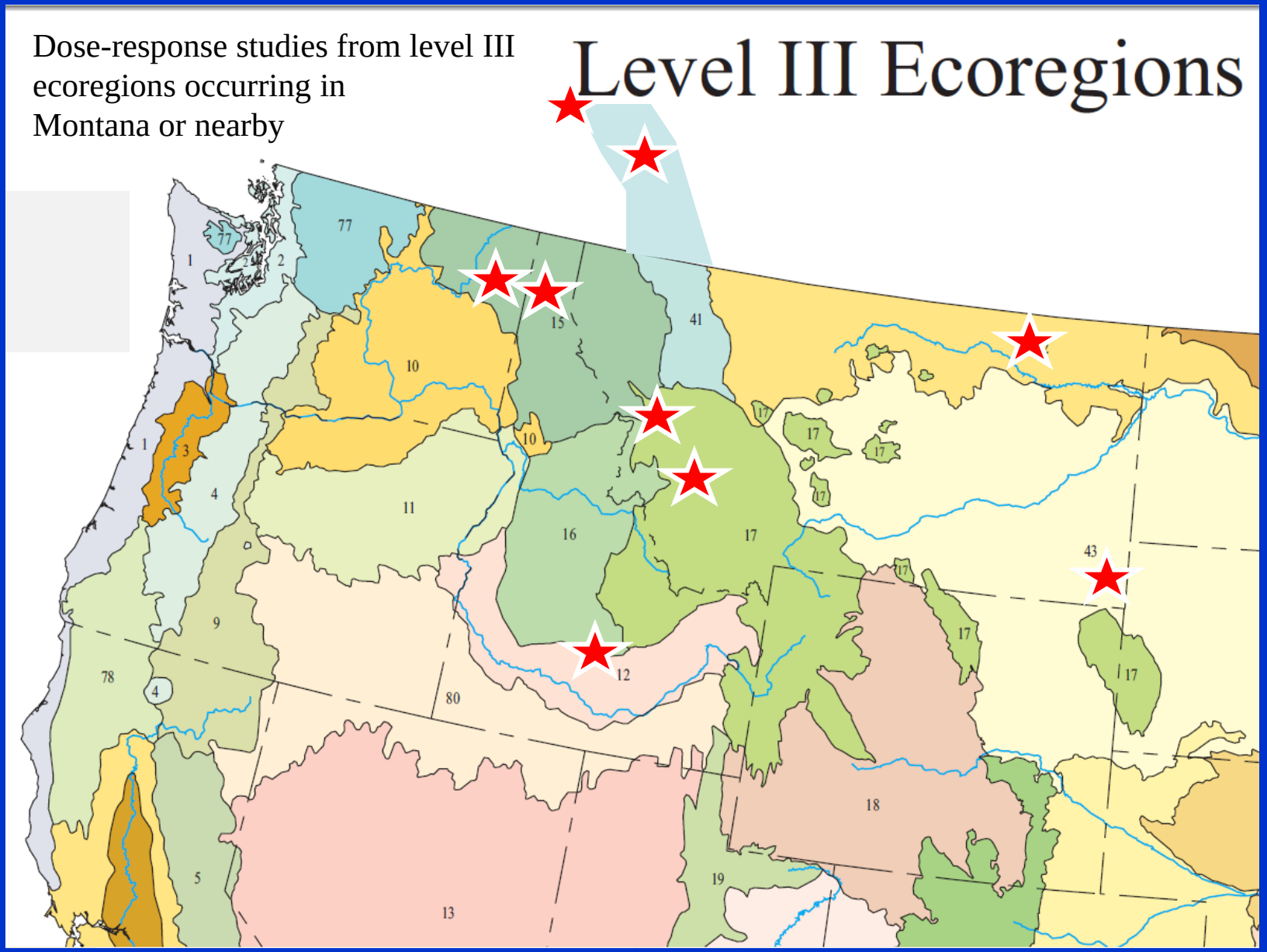


Mountainous

Transitional

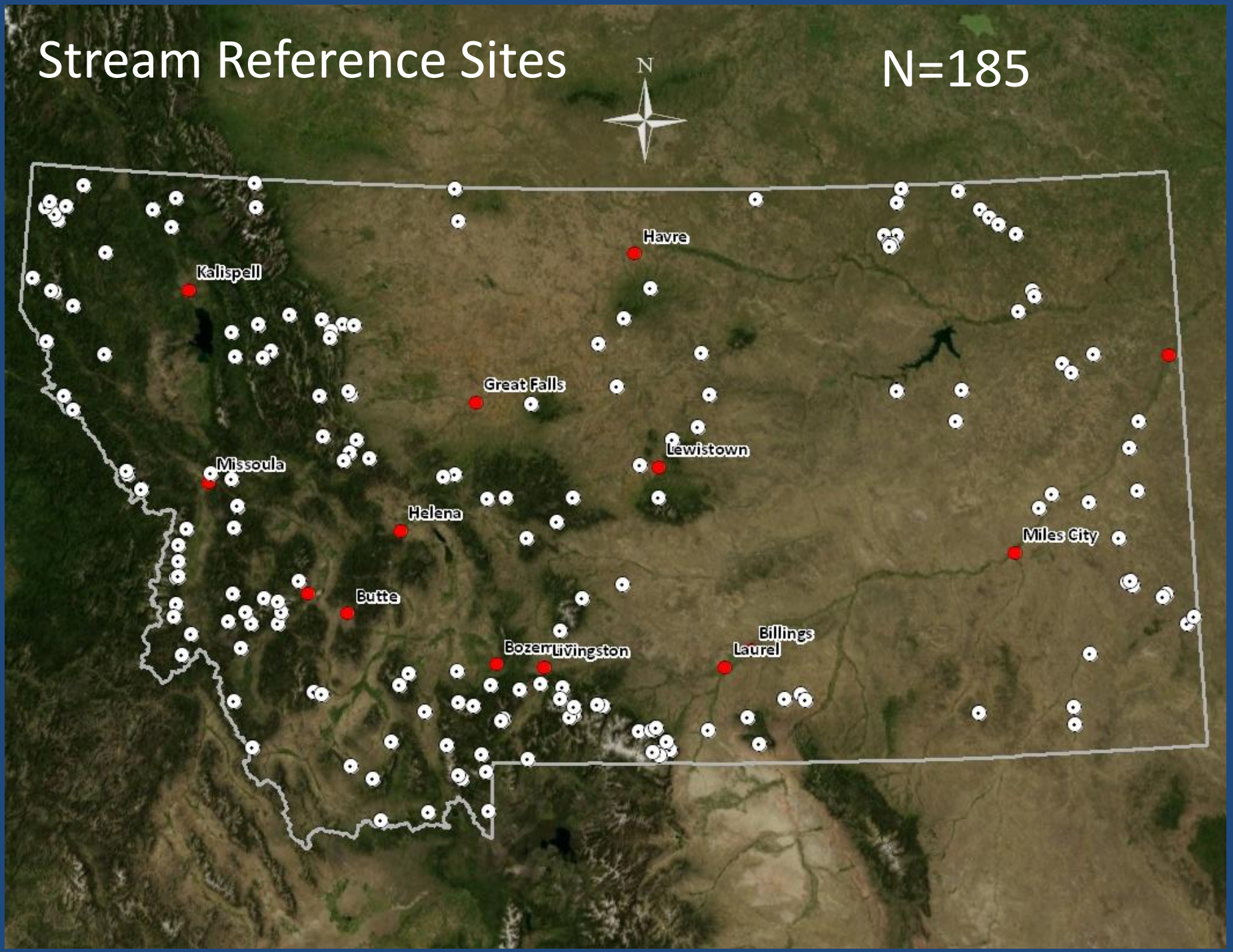
Prairie

Dose-response studies from level III ecoregions occurring in Montana or nearby

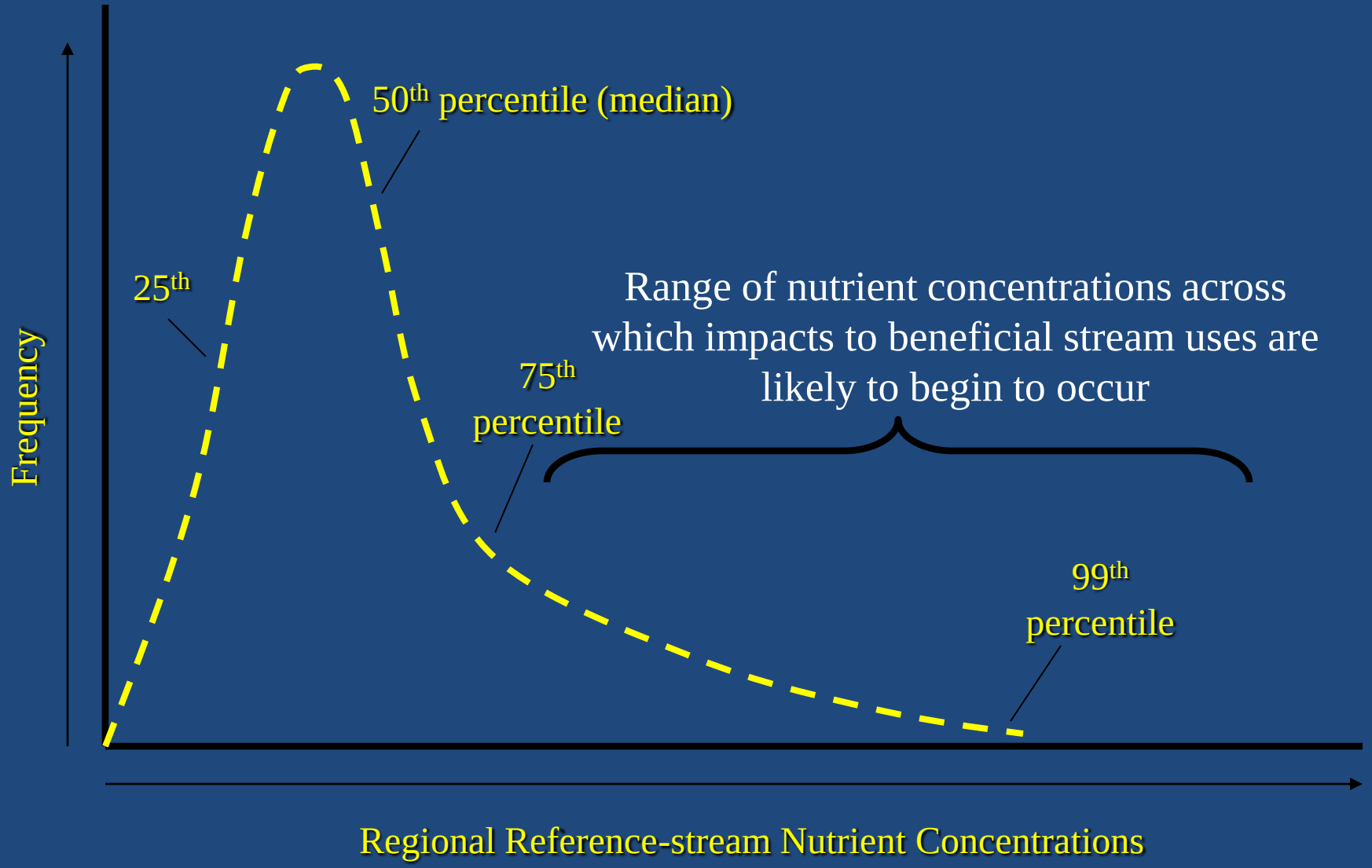


Stream Reference Sites

N=185



Comparing reference data and dose-response study results



Deriving Numeric Nutrient Criteria: Large Rivers

River Name	Segment Description
Big Horn River	Yellowtail Dam to mouth
Clark Fork River	Bitterroot River to state-line
Flathead River	Origin to mouth
Kootenai River	Libby Dam to state-line
Madison River	Ennis Lake to mouth
Missouri River	Origin to state-line
South Fork Flathead River	Hungry Horse Dam to mouth
Yellowstone River	State-line to state-line

- Traverse several ecoregions
- No reference site population for comparison
- Deeper/faster than streams; changes light regime and other factors

Using steady-state QUAL2K model

- Vary nutrient inputs, observe effects on water quality standards
  - Dissolved oxygen concentration, pH, total dissolved gas levels
  - Nuisance benthic algae levels
  - Total organic carbon concentration (drinking water use)

Examples of Draft Numeric Nutrient Criteria (July 2013)

Ecoregion (level III or IV) and Number, or Individual Reach Description	Period When Criteria Apply	Numeric Nutrient Standard	
		Total Phosphorus (µg/L)	Total Nitrogen (µg/L)
ECOREGION (level III or IV):			
Northern Rockies (15)	July 1 to September 30	25	275
Canadian Rockies (41)	July 1 to September 30	25	325
Idaho Batholith (16)	July 1 to September 30	25	275
Middle Rockies (17)	July 1 to September 30	30	300
Absaroka-Gallatin Volcanic Mountains (17i)	July 1 to September 30	105	250
Northwestern Glaciated Plains (42)	June 16 to September 30	110	1300
Sweetgrass Upland (42l), Milk River Pothole Upland (42n), Rocky Mountain Front Foothill Potholes (42q), and Foothill Grassland (42r)	July 1 to September 30	80	560
Northwestern Great Plains (43) and Wyoming Basin (18)	July 1 to September 30	150	1300
River Breaks (43c)	narrative criterion only	narrative criterion only	narrative criterion only
*Non-calcareous Foothill Grassland (43s), Shields-Smith Valleys (43t), Limy Foothill Grassland (43u), Pryor-Bighorn Foothills (43v), and Unglaciated Montana High Plains (43o)**	July 1 to September 30	33	440
INDIVIDUAL REACHES (Large Rivers):			
Yellowstone River (Bighorn River confluence to Powder River confluence)	August 1 -October 31	55	655
Yellowstone River (Powder River confluence to stateline)	August 1 -October 31	95	815

Most Streams Already Meet the Criteria

Based on probabilistic stream survey:

- About 70-80% of stream miles statewide currently meet the TP criteria
- About 85-90% of stream miles statewide currently meet the TN criteria

Nutrient impacts to lakes

- Loss of water clarity; reduced recreation/aesthetics & property value
- Increased frequency of noxious algae blooms

- Changes in fish species composition
- Loss of macrophytes, replaced by dense phytoplankton
- Taste and odor problems (drinking water source)

Nutrient Criteria Derivation: Lakes & Reservoirs

- Lakes: Under development
- Large Reservoirs: Under development. Plan to use a modeling approach
  - Canyon Ferry Reservoir first project; 2014
- Criteria for Flathead Lake will be recommended

Draft Recommended Criteria for Flathead Lake

		Numeric Nutrient Standard		
LAKE	Period of Application	Total P (µg/L)	Total N (µg/L)	Other Standards
Flathead Lake	Year-round	5.0	95	Primary productivity 100 g C/m^2· yr; Secchi depth ≥ 10.4 m during non turbidity-plume conditions. Phytoplankton chlorophyll *a* 1.0 µg/L, expressed as an annual average.

Data to assess standards compliance collected at one location (mid-lake deep)

Permitting Numeric Nutrient Criteria

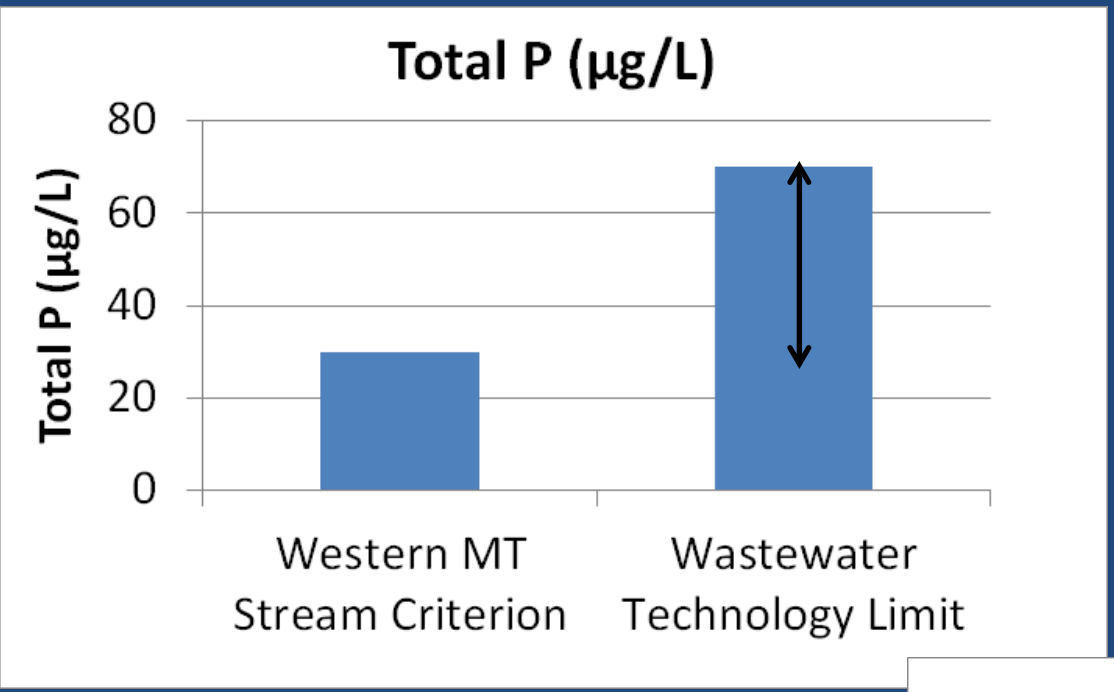
- Permits would be based largely on:
  - *Technical Support Document for Water Quality-based Toxics Control* (EPA, 1991)

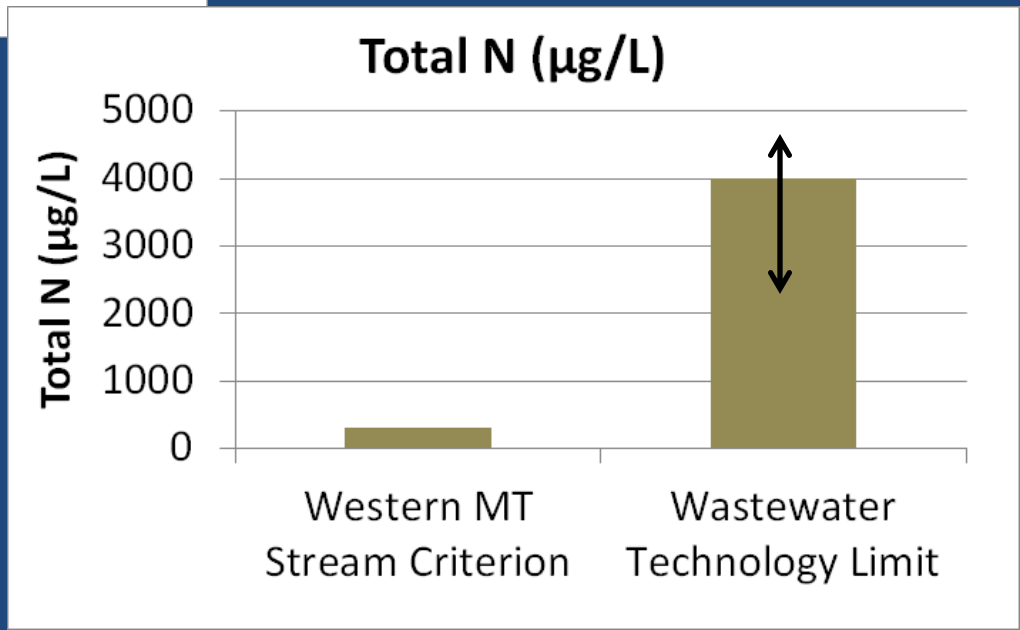
- DEQ proposing that parts of the document specific to chronic criteria be used to permit numeric nutrient criteria
  - Average Monthly Limit only; no Maximum Daily Limit
  - Use 95th percentile tables to evaluate effluent
  - Characterization of upstream water (i.e., for dilution) may be based on percentiles other than the 95th

Permitting Numeric Nutrient Criteria

- DEQ proposes the seasonal 14Q5 as the critical design flow for permitting nutrient standards
  - Lowest average 14 consecutive day low flow, occurring from July through October, with an average recurrence frequency of once in five years
- Other standards are usually calculated using the annual 7Q10

Implementation





Variances from Numeric Nutrient Criteria: Economic Considerations

- Options available for communities to receive temporary relief from the criteria based on:
  - Inability to pay for treatment/economics
  - Limits of technology

- Options apply only to wastewater treatment beyond federally mandated technology-based regulations (i.e., National Secondary Standards)

Senate bills 95 (2009 Legislature) and 367 (2011 Legislature) (now §75-5-313, MCA)

- DEQ given authority to grant variances from nutrient criteria
- Based on economic harm that would have resulted from immediate implementation of the standards
  - Variances up to 20 years, subject to 3-year reviews

  - General Variance: Can be requested if criteria can't be met but these can:
  - > 1 MGD: 1 mg TP/L, 10 mg TN/L
  - < 1 MGD: 2 mg TP/L, 15 mg TN/L
  - Lagoons: Maintain current performance

  Must be adopted in Dept. rule by 5/31/2016

  - Individual Variance: Permittee may apply for these if meeting the general variance is difficult, or if treating beyond gen. levels does not make sense. Requires case-by-case analysis.

OVERALL: Law allows Montana to implement numeric nutrient criteria in a staged manner over ~ 20 years, allowing critical time to better address all sources of nutrient pollution (point and nonpoint) and for treatment technology to improve/come down in cost

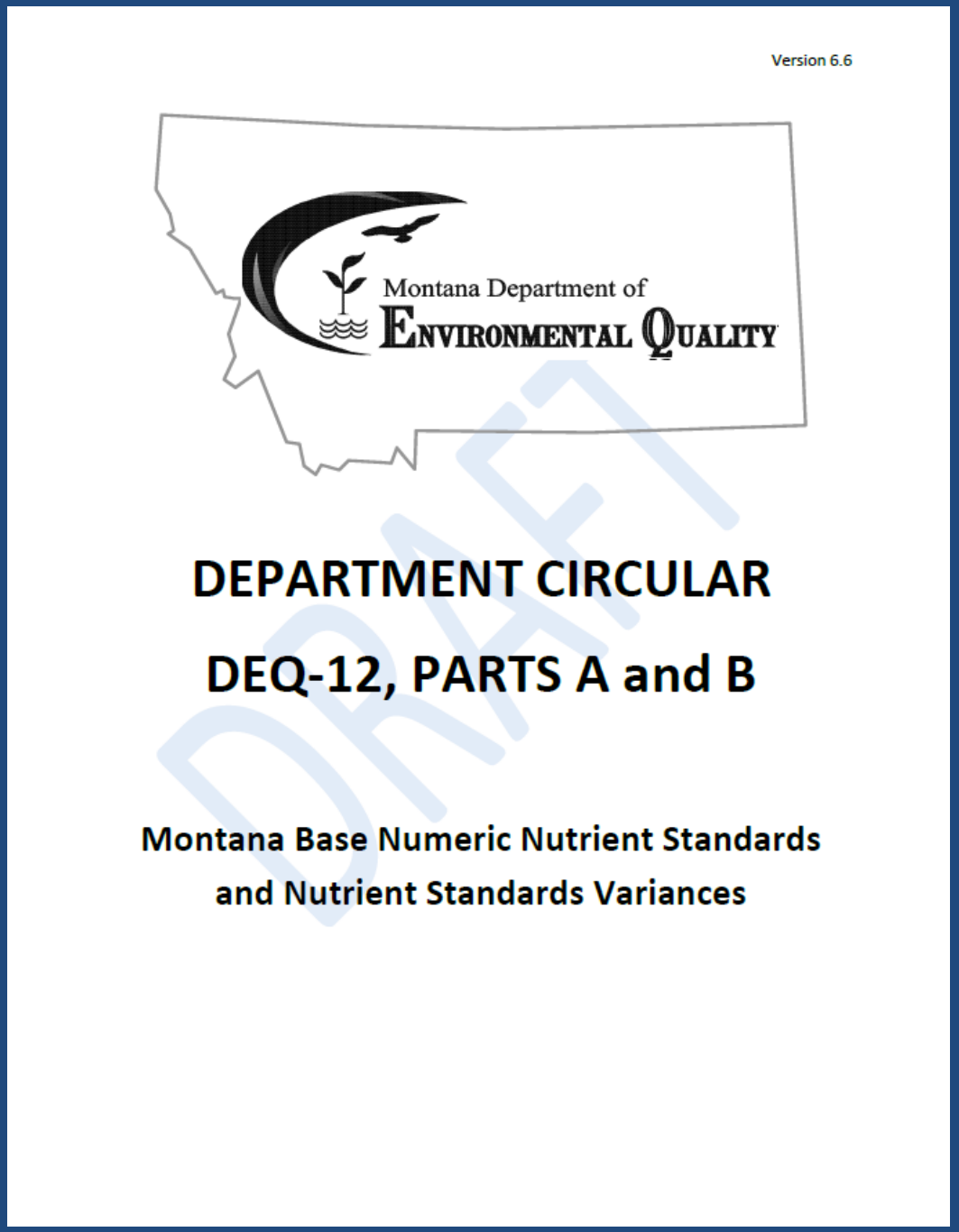
EPA supports Montana's approach

In a memo (1/3/2012) USEPA states:

- "We recognize the strong science-based work MDEQ has conducted over the past several years to develop draft NNC for N and P for wadeable streams"
- "EPA concludes that the issuance of variances would be consistent with the Clean Water Act and its implementing regulations."

Part A (criteria, permitting methods) adopted by Board of Environmental Review

Part B (variances) is Department rule making



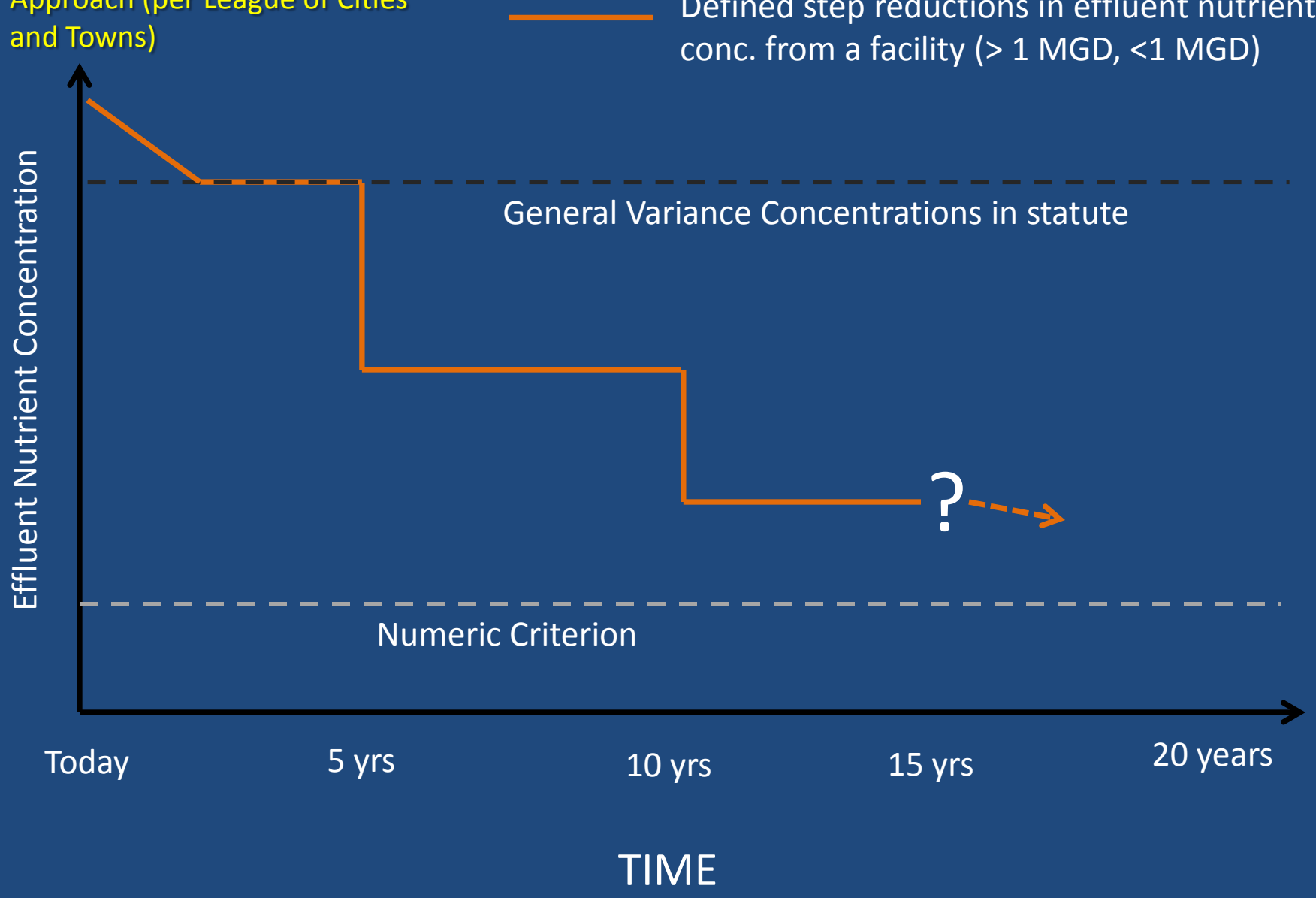
Ongoing Work

- Nutrient Work Group
  - Established per §75-5-313, MCA
  - Broad cross-section of MT stakeholders
    - 21 main members (3 DEQ, non-voting)
    - Meetings usually attended by 35-40 people
  - Advises DEQ, especially on implementation policy
  - 21 meetings since May 2009

Nondegradation and Numeric Nutrient Criteria

- Issue: difficult to meet "fraction of small numbers"
- Affects new dischargers, major concern for some stakeholders
- Working closely with affected stakeholders to resolve specifics of nondegradation and these criteria

Proposed Nutrient Reduction Approach (per League of Cities and Towns)



Other Planned Work

- Streamlined Site-specific Nutrient Criteria
  - Where biological indicators show healthy stream, but nutrient criteria exceeded
  - Within defined uncertainty range, sites-specific criteria could be IDed, proposed for adoption
- Educational Statewide Meetings
  - Inform dischargers about criteria, variance process, etc.

Overview

- Criteria are scientifically defensible, appropriate for different regions
  - Provide clarity as to the water quality endpoint
- Statute allows criteria to be met over ~20 years via variances
- DEQ and NWG working on remaining elements of implementation
  - Building in regulatory certainty over the variance period

Thank You

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When the Variance Ends

- Foreseeable actions if criteria are still not being achieved in some waterbodies in 20+ yrs:
  - Change state law to allow variances to go beyond 20 years
    - Good option if progress is occurring, but incomplete
  - Lower or remove beneficial uses in the impacted streams
    - Water Quality standards rule change
    - Would require a Use Attainability Analysis, EPA approval